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China

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CHINA

China's growth pattern is currently changing, with a reduction in the rate of growth and an attempt to rebalance the economy from exports and investment towards private consumption. Innovation plays an increasing role, as illustrated by the fact that China spent 1.98% of GDP on R&D in 2012, closing the gap with the EU28.

Hot issue 1: Encouraging innovation in firms and supporting entrepreneurship and SMEs. The business sector accounts for 74% of GERD (1.51% of GDP, 2012), and Chinese firms are active both as R&D performers and contractors (Panel 1[d, o]). Although the number of patent applications by Chinese residents has soared in recent years, Chinese innovation output is still lagging in terms of international patenting and trademark registration (Panel 1[f, g]) by OECD standards. There is a lack of venture capital and the business environment is difficult for innovative start-ups. The dominance of state-owned enterprises (SOEs), especially in public utilities, tends to mitigate the pressures to innovate that normally arise from competition. Improving the business sector's innovation capability is therefore a key challenge. Various policy instruments foster an enterprise-centred innovation system and emphasise the indigenous innovation capacity of Chinese firms. The tax incentive was revised in 2013 to expand the range of eligible R&D costs and make not-for-profit R&D organisations eligible for tax allowances on imported R&D equipment. Tax incentives are granted to firms investing in education and training programmes. The corporate income tax and the value added tax have been reduced for high-technology enterprises, SMEs and ICT firms in order to support their development.

Hot issue 2: Innovating to address to social challenges. China faces serious social challenges in terms of food security, public health and ageing, all of which will require contributions from STI. The National S&T Major Projects therefore focus strongly on public health, ageing, food and drug safety, and disaster prevention. Energy and health are among the four sectoral focuses of the Innovation 2020 Programme of the Chinese Academy of Sciences. China has also promoted "inclusive innovation", i.e. innovation by and for low-income people. Existing initiatives include the Spark Programme, which promotes agricultural and rural developments by facilitating peasants' access to relevant technologies and related training and the S&T Programme for Public Wellbeing, which supports the commercialisation of technologies that can benefit social development, both implemented under the Ministry of S&T.

Hot issue 3: Innovating to contribute to sustainable and green growth. The main priority is to enhance the contribution of STI to China's transition to an ecologically sustainable mode of development. China's green productivity, at USD 1.3 (GDP per unit of CO_2 emitted, 2011), was much lower than EU27's at USD 4. At 4.1% a year, however, it grew faster than the OECD median at 1.8% over 2007-11. The government's 12th Five-Year Plan (2011-15) sets the target for green productivity growth at 17% over the five-year period. The present 12th Five-Year-Plan for S&T Development therefore focuses considerable attention on energy and climate change and has triggered a new wave of industrial policies in support of clean energy industries and related low-carbon technologies. Yet, China's RTA in biotechnology and green technologies has slipped considerably (Panel 3).

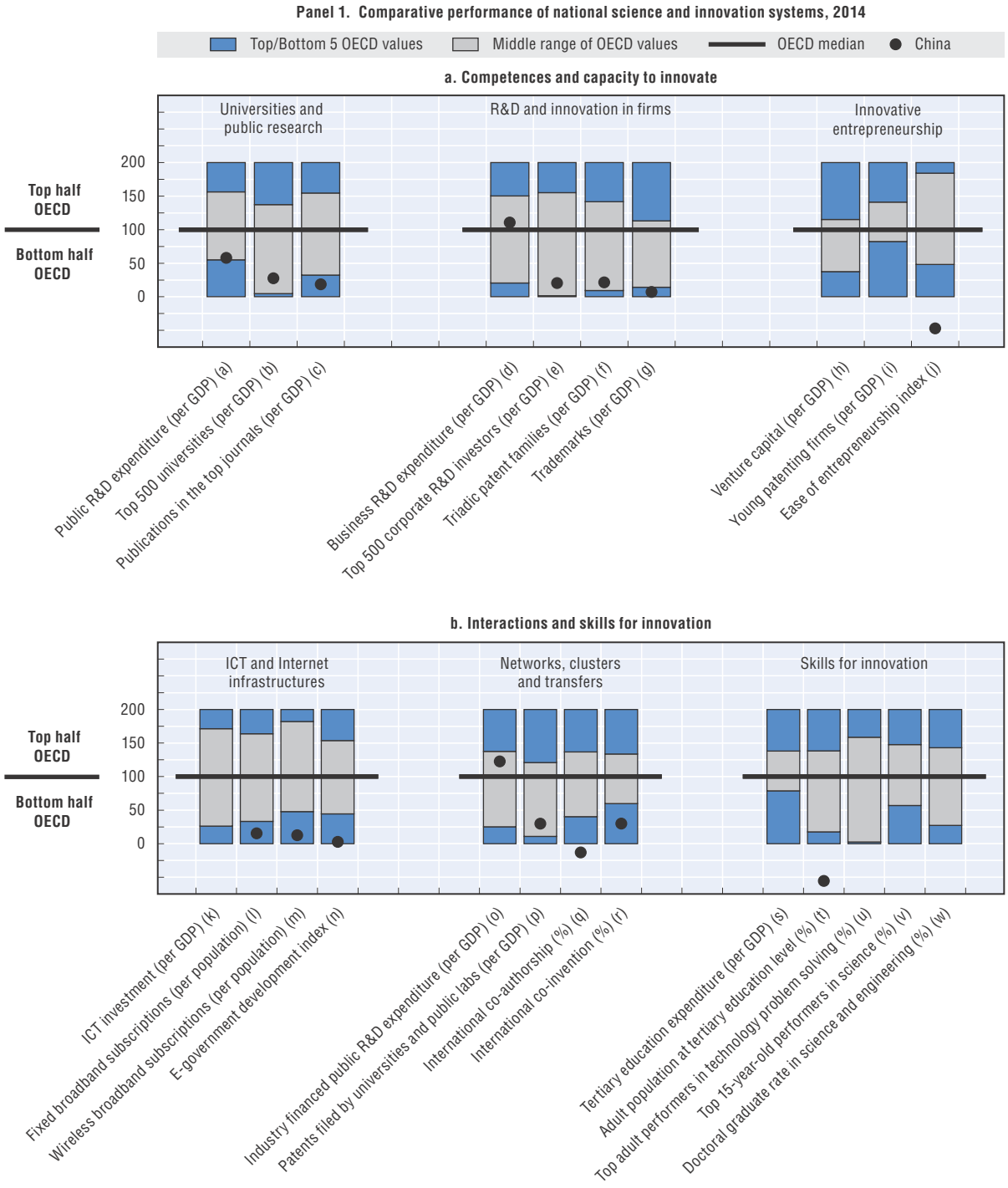
Hot issue 4: Strengthening public R&D capacity and infrastructures. Although many PRIs became corporate entities as part of the reform of the S&T system in the early 2000s, PRIs still dominate China's public research and are strongly oriented towards applied and experimental R&D (Panel 4). The government issued "Opinions on Deepening the Reform of the Scientific and Technological System and Speeding up the Building of a National Innovation System" in September 2012. The new round of PRI reforms aims to clarify the roles of the three types of PRI (commercial innovation, social welfare and basic research), and to establish appropriate governance, management and funding mechanisms to fulfil their missions.

Hot issue 5: Fostering high-end human resources for S&T and research. Although China has the world's largest pool of human resources for S&T, the tertiary-qualified share of the population is still extremely low (Panel 1[t]). Furthermore, China lacks world-class researchers. Both the Thousand Talents Programme approved by the Organisation Department of the Chinese Communist Party and the 100 Talents of the Chinese Academy of Sciences aim to attract and retain top-tier academics, including from overseas. The

Key figures, 2013

Economic and environmental performance	CHN	OECD	Gross domestic expenditure on R&D	CHN	OECD
Labour productivity			**GERD**		
GDP per hour worked, USD PPP, 2013	n.a.	47.7	Million USD PPP, 2012	293 550	1 107 398
(annual growth rate, 2008-13)	n.a.	(+0.8)	As a % of total OECD, 2012	26.5	100
Green productivity			**GERD intensity and growth**		
GDP per unit of CO_2 emitted, USD, 2011	1.3	3.0	As a % of GDP, 2012	1.98	2.40
(annual growth rate, 2007-11)	(+4.1)	(+1.8)	(annual growth rate, 2007-12)	(+17.2)	(+2.0)
Green demand			**GERD publicly financed**		
NNI per unit of CO_2 emitted, USD, 2011	n.a.	3.0	As a % of GDP, 2011	n.a.	0.77
(annual growth rate, 2007-11)	n.a.	(+1.6)	(annual growth rate, 2007-12)	(+14.2)	(+2.8)

Figure 9.8. **Science and innovation in China**



Note: Normalised index of performance relative to the median values in the OECD area (Index median = 100).

National Plan for Science and Technology Talent Development (2010-20) addresses the business sector's need for innovative personnel, by supporting mobility of the highly skilled and by investing in innovation platforms and national key labs to cultivate talented, leading R&D personnel. Living allowances and funding for postdoctoral research in enterprises are provided as well.

Highlights of the Chinese STI system

STI policy governance: A leading group of the S&T system reform, involving some 20 ministries and national agencies was set up in 2012. A mid-term evaluation of the S&T Development Plan 2006-20 was launched in 2014, and the methods and standards for evaluating the Industry-Research Strategic Alliance for Technological Innovation were issued in 2012. The management of main S&T programmes have been revised to simplify the application process; scientists applying for projects funding run by MOST do not have to conduct the Q&A session in person, as most of the application and evaluation procedures can be done through the Internet, while the budget management system was improved by building the project library and S&T programme information system.

ICT and Internet infrastructures: While ICT infrastructures have developed rapidly in China, ICT use per capita and e-government readiness are still very low by OECD standards (Panel 1[l, m, n]). China has been investing in S&T infrastructures through the R&D Infrastructure and Facility Development Programme since 2005, with an estimated budget of USD 1.5 billion (CNY 5 billion).

Technology transfer and commercialisation: In 2013, the Legislative Affairs Office of the State Council started to revise the Law on Promoting the Transfer of Scientific and Technological Achievement. The number of Industry-Research Technology Strategic Alliances for Technological Innovation increased from four in 2007 to 146 in 2013.

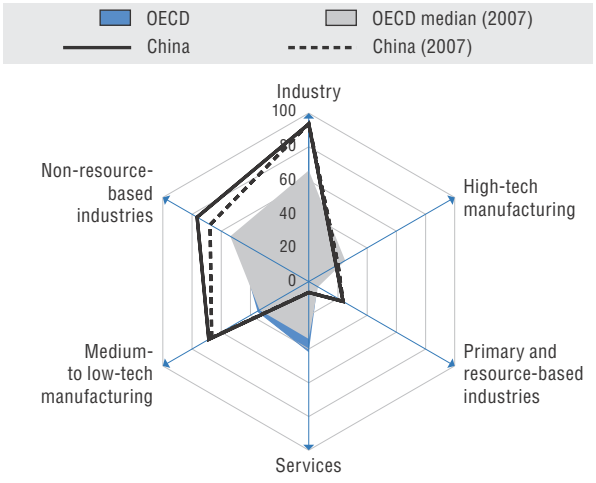
Clusters and smart specialisation: China's national innovation system features marked regional disparities. The government has used the innovation demonstration zones as an important policy instrument to spearhead innovation in regions with relatively advantageous innovation capabilities. So far three zones have been set up in Zhongguncun in Beijing, East Lake in Wuhan and Zhangjiang in Shanghai. Enterprises located in these zones enjoy preferential policies and public support for their innovative activities. Furthermore, the Framework for Development and Reform Planning for the Pearl River Delta Region (2008-20) aims to make the region an innovative centre in the Asia-Pacific area. By 2012, China had 105 high-technology zones, hosting about half of the national technology incubators, and 132 Economic and Technological Development Zones, which have in recent years expanded from the fast-growing coastal cities to other regions. To boost the development of the western region, the Great Western Exploration Strategy supports investments in research infrastructure, research collaboration and human resource mobility between the eastern and western regions.

Globalisation: China's science and innovation systems are weakly linked to global networks, as shown by its very low share of co-authorship and co-invention (Panel 1[q, r]). The government seeks to improve the openness of the STI system through continued government co-operation on S&T and diversification of the ways in which Chinese enterprises and PRIs interact with foreign counterparts. In recent years, China has also increased its participation in large-scale international collaborative projects, such as the EU 7th Framework Programme, and has engaged in annual bilateral dialogues with key partner countries, such as the United States and Germany, on STI co-operation.

Recent developments in STI expenditure: China's R&D intensity has tripled since 1998, reaching 1.98% of GDP in 2012, approaching the level of EU28 as a whole. BERD as a share of GERD rose to the top level of OECD countries and firm self-funded R&D reached 95% of BERD in 2012.

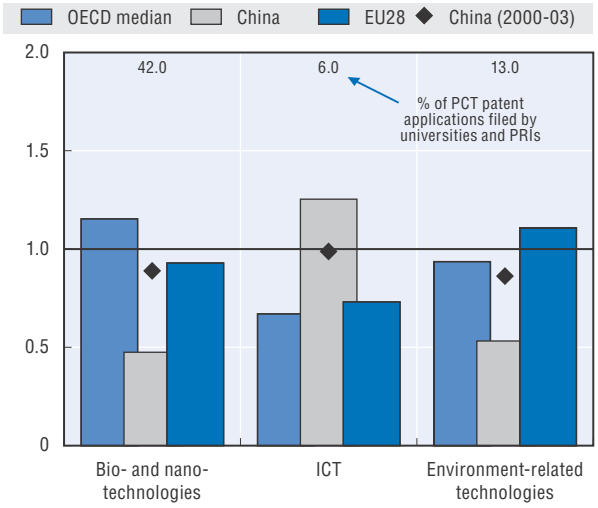
Panel 2. Structural composition of BERD, 2011

As a % of total BERD or sub-parts of BERD

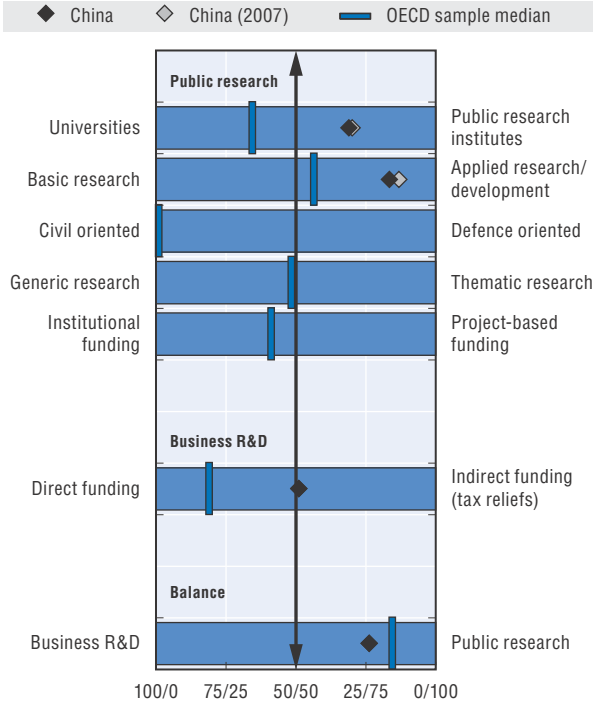


Panel 3. Revealed technology advantage in selected fields, 2009-11

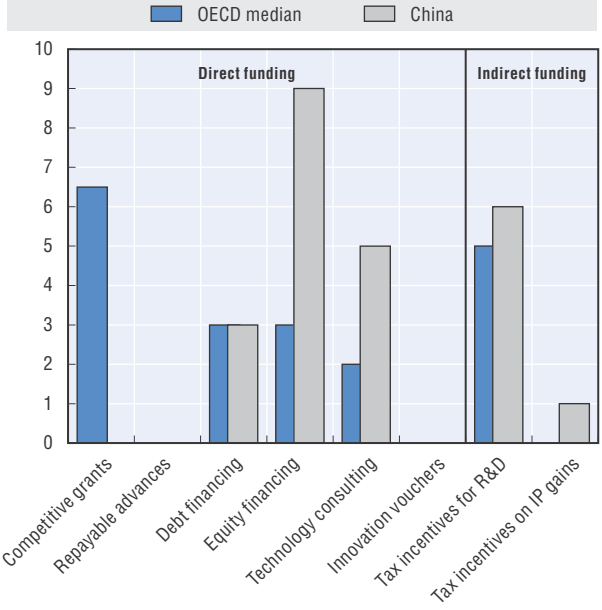
Index based on PCT patent applications



Panel 4. Allocation of public funds to R&D, by sector, type and mode of funding, 2012



Panel 5. Most relevant instruments of public funding of business R&D, 2014



Note: Policy information comes from country responses to the OECD STI Outlook policy questionnaires 2014 and 2012. China's responses are available in the *OECD STI Outlook Policy Database*, edition 2014 at *http://qdd.oecd.org/Table.aspx?Query=AF0BD43B-D359-4A89-BBF3-449C90AC037F*.
Source: See reader's guide and methodological annex.

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STI country profiles reader's guide

The country profiles (CPs) in the 2014 *OECD STI Outlook* (STIO) are designed to provide a concise overview of science, technology and innovation (STI) policy and performance in OECD members and selected non-OECD economies. Each country profile is based on information gathered from the country's response to the OECD STIO policy questionnaires 2012 and 2014, as well as various additional OECD and non-OECD sources.

Headings in the country profiles are linked to the STIO policy profiles, which examine the main global STI policy trends across countries. Issues featuring in both the policy and country profiles are: *i)* innovation policy governance; *ii)* new sources of growth; *iii)* new challenges; *iv)* universities and public research; *v)* innovation in firms; *vi)* innovative entrepreneurship; *vii)* technology transfer and commercialisation; *viii)* clusters and smart specialisation; *ix)* globalisation; and *x)* skills for innovation.

The table of key figures presents indicators on the country's economic performance (labour productivity), environmental performance (green productivity and demand), the size of its R&D system as measured by gross domestic expenditure on R&D (GERD), the degree of public commitment to S&T as measured by the share of GERD that is publicly financed, and the changes in these indicators over the past five years. In the text, all amounts are given both in USD in purchasing power parities (PPP) of the relevant year (if available) and in national currencies.

Panel 1 contains a double figure that sheds light on the strengths and weaknesses of the country's STI performance. It uses indicators on the country's national innovation system and performance with respect to: universities and public research, business R&D and innovation, innovative entrepreneurship, information and communication technology (ICT) and Internet infrastructure, networks, clusters and transfers, and skills for innovation. The dot for each indicator positions the country relative to the OECD median and to the top and bottom five OECD countries. Non-OECD countries are also compared to the OECD benchmarks, and may fall out of the range indicated in the figure (e.g. below the lowest OECD country). All indicators are normalised (by GDP and population cohorts) to take account of the size of the economy and the relevant population cohorts, and are presented as indices (OECD median = 100) for benchmarking purposes.

Panel 2 shows the structural composition of business expenditure on R&D (BERD) in terms of performance of the main industry sectors, firm size and firms' national affiliation. It reflects the country's industry structure and its business innovation efforts. Panel 3 presents the country's revealed technological advantage (RTA), as measured by international patent applications filed under the Patent Cooperation Treaty (PCT) in three key technology fields (bio- and nano-technology, ICTs, and environment-related technologies). It also shows the number of patents filed by universities and public research institutions in these fields.

Panel 4 gives an overview of the country's policy mix for public R&D, i.e. the orientation and funding modes of public research. It also illustrates changes in the policy mix for R&D over the past five years. Finally, Panel 5, a new feature in STIO 2014, reflects the balance and relative importance of various government measures to support business R&D and innovation. It is based on the country's self-assessment in its reply to the OECD STIO 2014 policy questionnaire.

Further details on the methodology, data sources and descriptions of indicators used in the country profile are provided in Annex 9.A. Data, metadata as well as the original sources and databases of the indicators used in the STIO 2014 are accessible at the statistical portal IPP.Stat (cut-off date: 8 July 2014).

Abbreviations used in the country profiles

BERD: Business expenditure on research and development

EU: European Union

FDI: Foreign direct investment

GDP: Gross domestic product

GERD: Gross expenditure on research and development

HEIs: Higher education institutions

IPRs: Intellectual property rights

MNEs: Multinational enterprises

PRIs: Public research institutes

R&D: Research and development

S&E: Science and engineering

SSS: Smart specialisation strategy (also known as 3S)

STI: Science, technology and innovation

S&T: Science and technology

3S: See SSS

STEM: Science, technology, engineering and mathematics

USD: United States dollars
(converted using the purchasing power parities of the relevant year)

VC: Venture capital

Synthetic table

Table 9.1. **Comparative performance of national science and innovation systems, 2014**

Country relative position: in the top 5 OECD or above (★), in the middle range on par or above OECD median (▲), in the middle range below OECD median (Δ) and in the bottom 5 OECD or below (○)

		Competences and capacity to innovate									
		Universities and public research			R&D and innovation in firms				Innovative entrepreneurship		
		Public R&D expenditure (per GDP)	Top 500 universities (per GDP)	Publications in the top-quartile journals (per GDP)	Business R&D expenditure (per GDP)	Top 500 corporate R&D investors (per GDP)	Triadic patent families (per GDP)	Trademarks (per GDP)	Venture capital (per GDP)	Young patenting firms (per GDP)	Ease of entrepreneur-ship index
		PUB_XGDP	UNI500_GDP	PUB25_GDP	BE_XGDP	CORPRD500_GDP	PTRIAD_GDP	TRDMRK_GDP	VC_XGDP	PTYG_GDP	EASE_I
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Argentina	ARG	Δ	Δ	○	○	○	○	○			
Australia	AUS	▲	▲	▲	▲	Δ	Δ	▲	Δ		▲
Austria	AUT	▲	★	▲	▲	▲	▲	Δ	Δ	★	▲
Belgium	BEL	Δ	▲	▲	▲	Δ	▲	Δ	▲	Δ	Δ
Brazil	BRA		Δ	○		Δ	○	○			Δ
Canada	CAN	▲	▲	▲	Δ	Δ	▲	★	★	○	▲
Chile	CHL	○	Δ	○	○	○	○	Δ			Δ
China	CHN	Δ	Δ	○	▲	Δ	Δ	○			○
Colombia	COL	○	○	○	○						
Costa Rica	CRI	○	○	○	○	○					
Czech Republic	CZE	▲	Δ	Δ	Δ	Δ	Δ	Δ	○		Δ
Denmark	DNK	★	▲	★	▲	★	▲	▲	▲		▲
Estonia	EST	▲		▲	▲	○	Δ	Δ	▲		▲
Finland	FIN	★	★	▲	★	★	★	▲	★	★	▲
France	FRA	▲	Δ	Δ	▲	▲	▲	▲	▲	Δ	▲
Germany	DEU	★	▲	Δ	▲	▲	★	▲	▲	★	▲
Greece	GRC	○	Δ	Δ	○	Δ	○	○	○		Δ
Hungary	HUN	○	Δ	Δ	Δ	Δ	Δ	○	Δ		Δ
Iceland	ISL	★	○	★	▲	▲	Δ	★			Δ
India	IND	Δ	○	○	○	○	Δ	○			○
Indonesia	IDN		○	○	○		○	○			Δ
Ireland	IRL	Δ	▲	▲	Δ	▲	▲	▲	★	○	Δ
Israel	ISR	Δ	★	▲	★	▲	▲	▲	★		○
Italy	ITA	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	▲	★
Japan	JPN	▲	Δ	○	★	▲	★	Δ	Δ	○	▲
Korea	KOR	▲	Δ	Δ	★	▲	▲	▲	▲		Δ
Latvia	LVA	Δ	○	○	○		Δ				
Lithuania	LTU	Δ	○	○	○		Δ				
Luxembourg	LUX	○	○	Δ	Δ	★	▲	★	Δ		Δ
Malaysia	MYS	Δ	Δ	○	Δ	Δ					
Mexico	MEX	○	○	○	○	○	○	Δ			○
Netherlands	NLD	▲	▲	★	▲	▲	▲	▲	▲	▲	★
New Zealand	NZL	Δ	★	▲	Δ	Δ	Δ	★	Δ		★
Norway	NOR	▲	▲	Δ	Δ	▲	Δ	Δ	Δ	▲	Δ
Poland	POL	Δ	Δ	Δ	○	○	Δ	○	○		○
Portugal	PRT	Δ	▲	▲	Δ	Δ	Δ	Δ	Δ		▲
Russian Federation	RUS	Δ	○	○	Δ	Δ	○	○	Δ		Δ
Slovak Republic	SVK	Δ	○	○	○	○	○	○			★
Slovenia	SVN	Δ	▲	▲	▲	Δ	Δ	Δ	Δ		Δ
South Africa	ZAF	○	Δ	○	Δ	Δ	Δ	Δ	Δ		○
Spain	ESP	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	○	○
Sweden	SWE	★	★	★	★	★	★	▲	▲	★	Δ
Switzerland	CHE	▲	▲	★	▲	★	★	★	▲	★	▲
Turkey	TUR	Δ	○	○	Δ	Δ	○	○			○
United Kingdom	GBR	Δ	▲	▲	Δ	▲	▲	▲	▲	Δ	▲
United States	USA	▲	Δ	Δ	▲	▲	▲	▲	★	○	★
EU28	EU28	▲	▲	★	▲	Δ	▲	Δ	▲	▲	

Table 9.1. **Comparative performance of national science and innovation systems, 2014** *(cont.)*

Country relative position: in the top 5 OECD or above (★), in the middle range on par or above OECD median (▲), in the middle range below OECD median (Δ) and in the bottom 5 OECD or below (○)

		Interactions and skills for innovation												
		ICT and Internet infrastructures				Networks, clusters and transfers				Skills for innovation				
		ICT investment (per GDP)	Fixed broadband subscribers (per population)	Wireless broadband subscribers (per population)	E-government readiness index	Industry financed public R&D expenditure (per GDP)	Patents filed by universities and public labs (per GDP)	International co-authorship (%)	International co-invention (%)	Tertiary education expenditure (per GDP)	Adult population at tertiary education level (%)	Top adult performers in technology problem solving (%)	Top 15 year-old performers in science (%)	Doctoral graduate rate in science and engineering (%)
		ICTINV_XGDP	FBBAND_HAB	WBBAND_HAB	EGOV_I	PUB_BEF_XGDP	PATPRI_XGDP	INTCOA_XSA	COPAT_XPCT	TER_XGDP	ADTERPOP_XT	TOPAD_PST_XAD	TOP15_SCI_XT	PHDR_SCIENG_XCOH
		(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)
Argentina	ARG		○	○	○	○		Δ	★	▲	○		○	○
Australia	AUS	▲	Δ	★	▲	▲	▲	Δ	Δ	▲	▲	▲	★	▲
Austria	AUT	▲	Δ	▲	Δ	▲	Δ	★	▲	Δ	Δ	Δ	Δ	▲
Belgium	BEL	▲	▲	Δ	Δ	▲	▲	★	★	Δ	▲		▲	▲
Brazil	BRA		○	Δ	○		Δ	○	Δ	○	○		○	○
Canada	CAN	Δ	▲	Δ	▲	▲	▲	Δ	▲	★	★	▲	▲	▲
Chile	CHL		○	○	Δ	○	Δ	▲	Δ	★	○		○	○
China	CHN		○	○	○	▲	Δ	○	○		○			○
Colombia	COL		○	○	Δ			▲	Δ	★	Δ		○	
Costa Rica	CRI		○	○	○			★	★		Δ		○	
Czech Republic	CZE	Δ	Δ	Δ	○	Δ	Δ	Δ	▲	Δ	Δ	Δ	Δ	Δ
Denmark	DNK	★	★	★	★	Δ	★	▲	▲	▲	Δ	★	Δ	▲
Estonia	EST		Δ	▲	Δ	Δ		▲	★	▲	▲	○	★	Δ
Finland	FIN	Δ	▲	★	▲	★	▲	▲	Δ	★	▲	★	★	★
France	FRA	Δ	★	Δ	▲	Δ	★	▲	Δ	▲	Δ		▲	▲
Germany	DEU	Δ	▲	Δ	▲	★	▲	Δ	Δ	Δ	Δ	▲	▲	★
Greece	GRC	○	Δ	Δ	Δ	Δ	○	Δ	▲	▲	Δ		○	Δ
Hungary	HUN		Δ	○	Δ	▲	○	▲	▲	○	Δ		Δ	○
Iceland	ISL		▲	▲	Δ	★		★	▲	○	▲		Δ	Δ
India	IND		○	○	○		Δ	○	▲	○				
Indonesia	IDN		○	○	○			▲	★	○	○		○	○
Ireland	IRL	○	Δ	▲	Δ	○	★	▲	▲	▲	▲	○	▲	▲
Israel	ISR		Δ	Δ	▲	▲	★	Δ	Δ	▲	★		Δ	▲
Italy	ITA	Δ	Δ	Δ	Δ	○	Δ	Δ	○	○	○		Δ	Δ
Japan	JPN	★	▲	▲	▲	Δ	▲	○	○	▲	★	▲	★	Δ
Korea	KOR	▲	★	★	★	▲	★	○	○	★	★	○	▲	Δ
Latvia	LVA		Δ	Δ	Δ	▲		Δ	★	▲	Δ		○	Δ
Lithuania	LTU		Δ	○	Δ	★		Δ	Δ		▲		Δ	
Luxembourg	LUX	○	▲	▲	▲	Δ	Δ	★	★	○	▲		▲	
Malaysia	MYS		○	○	Δ			Δ	Δ	★	○		○	
Mexico	MEX	○	○	○	○	○	○	Δ	▲	Δ	○		○	○
Netherlands	NLD	▲	★	▲	★	★	▲	▲	Δ	▲	Δ	★	▲	Δ
New Zealand	NZL	★	▲	▲	▲	★	Δ	▲	Δ	▲	▲		★	▲
Norway	NOR		▲	▲	▲	▲	Δ	▲	Δ	▲	▲	★	Δ	▲
Poland	POL		○	▲	○	Δ	Δ	○	★	Δ	Δ	○	▲	○
Portugal	PRT	▲	Δ	○	Δ	○	Δ	▲	▲	Δ	○		○	Δ
Russian Federation	RUS		○	Δ	Δ	★	○	○	Δ	Δ	★		○	○
Slovak Republic	SVK	○	○	Δ	○	Δ		Δ	▲	○	Δ	○	Δ	▲
Slovenia	SVN	Δ	Δ	Δ	Δ	▲	Δ	Δ	Δ	Δ	Δ		▲	▲
South Africa	ZAF		○	○	○	Δ	Δ	Δ	Δ	○	○			○
Spain	ESP	Δ	Δ	Δ	Δ	▲	▲	Δ	Δ	Δ	Δ		Δ	Δ
Sweden	SWE	★	▲	★	▲	▲	○	▲	Δ	▲	▲	★	Δ	★
Switzerland	CHE	★	★	Δ	▲		▲	★	★	Δ	▲		▲	★
Turkey	TUR		○	○	○	▲	○	○	○	Δ	○		○	○
United Kingdom	GBR	▲	▲	▲	★	Δ	▲	Δ	▲	Δ	▲		▲	★
United States	USA	▲	▲	▲	★	Δ	▲	○	○	★	★	Δ	Δ	Δ
EU28	EU28	Δ	▲	▲		Δ	▲	▲	▲		Δ		Δ	▲

Note: Non-OECD countries are also compared to OECD countries and may therefore be out of range (e.g. lower than the lowest OECD country). They appear in this table with top five and bottom five OECD values

Israel: "The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law."

Source: See references and methodological annex of the OECD STI Outlook 2014 country profiles.

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